TECHNICAL REFERENCE

Nitrax Mathematical Keyboard

Symbol Input Method, Compatibility, Hardware, Privacy, and Usage Guide

VERSION	AUTHOR	DATE	DOI
1.0	Rony Sitbon	June 2026	10.5281/zenodo.20744644

Publisher: Nitrax Mathematical Keyboard

mathematicalkeyboard.com/nitrax-mathematical-keyboard-technical-reference/

1. Abstract and document status

The Nitrax Mathematical Keyboard is a compact physical keyboard designed to simplify the entry of mathematical, Greek, and scientific symbols in standard desktop applications. This technical reference documents its physical layout, two-layer symbol input method, Windows companion application, application compatibility, hardware characteristics, connectivity, privacy model, setup process, limitations, and troubleshooting procedures.

The resource is intended for students, educators, researchers, engineers, scientists, and other users who regularly write mathematical or technical content.

> **Document status**
>
> This is a first-party technical reference, not a peer-reviewed research paper and not a controlled performance study. It documents the product, its design intent, and verified operating procedures as of Version 1.0.

Publication metadata

Full title	Nitrax Mathematical Keyboard: Technical Reference, Symbol Input Method, Compatibility, and Usage Guide
Author	Rony Sitbon
Publisher	Nitrax Mathematical Keyboard
Version	1.0
Publication date	June 2026
Language	English
Resource type	Technical report
License	Creative Commons Attribution 4.0 International for this report and original supporting documentation
Persistent identifier	DOI: 10.5281/zenodo.20744644

Scope of this reference

The report covers the symbol input layers, Windows companion software, application compatibility, hardware and connectivity, privacy and trust, setup, troubleshooting, limitations, versioning, and official resources.

2. Problem context and design objective

Mathematical writing on general-purpose computers often requires users to interrupt their writing flow to search symbol menus, memorize codes, switch input systems, or copy and paste characters from external sources. These interruptions are small individually but recurrent in STEM coursework, teaching, research, engineering, and technical communication.

The Nitrax design objective is to reduce this interaction cost by making frequently used symbols physically visible and consistently accessible through keyboard shortcuts, while preserving ordinary typing behavior.

Core design principles

Visible mappings

Symbols are printed on the keys so users do not need to memorize an invisible character map.

Consistent modifiers

The product uses two recurring modifier patterns rather than a separate command for every symbol.

Application independence

Symbols are inserted as standard Unicode text, allowing use across many ordinary applications.

Low-friction startup

The Windows utility is portable, requires no installer, no driver, and no administrator rights.

Local operation

The companion application runs locally and is designed without network access or telemetry.

Normal keyboard behavior

The device remains usable as a standard keyboard when Math Mode is disabled or the companion app is not running.

> **Value proposition**
>
> The primary benefit is reduced friction during technical writing: fewer menus, fewer copy-and-paste actions, and fewer context switches between the document and symbol sources.

Product boundary

The keyboard does not replace equation editors, computer algebra systems, LaTeX, or application-specific formatting tools. It accelerates character entry. The target application remains responsible for equation layout, typography, semantic math structure, and document formatting.

3. Symbol input model

The Nitrax keyboard uses two printed symbol layers. Each layer is activated by a consistent modifier combination, allowing the user to learn a small interaction pattern and apply it across the keyboard.

BLUE LAYER	**Ctrl + Alt**	Example: Ctrl + Alt + T -> √
GRAY LAYER	**Ctrl + Alt + Shift**	Example: Ctrl + Alt + Shift + J -> ∫

Typical workflow

1. Connect and power on the keyboard.
2. Run the Windows companion application.
3. Enable Math Mode from the system tray or with Ctrl + Alt + Shift + F12.
4. Open the target application and type normally.
5. Hold the appropriate modifier combination and press the key carrying the required symbol.

> **Efficient sequence entry**
>
> Ctrl + Alt can remain held while several blue-layer symbols are typed in succession. The same principle applies to the gray layer with Shift added.

Output model

The companion application inserts standard Unicode characters such as √, ∫, Σ, and Greek letters. Because the output is ordinary text, the result can be used in applications that accept standard keyboard input and support the corresponding glyphs.

Application behavior may differ when a program reserves the same shortcut. In that case, the application action may take priority over symbol insertion.

4. Windows companion application

The Windows companion application enables the printed mathematical layers. The keyboard itself operates as a normal keyboard without the application; the software is required only for the additional Nitrax symbol mappings on Windows.

Deployment model

Portable executable

The application is distributed as a single executable file and does not use an installation wizard.

User-level process

No administrator rights, system driver, or Windows service are required.

System tray control

The tray icon provides Math Mode, Start with Windows, Help, and Quit controls.

Simple updates

Updating consists of quitting the current application, downloading the latest release, and running it.

Math Mode toggle

Double-click the tray icon or use Ctrl + Alt + Shift + F12 to enable or disable the symbol layers.

Exit hotkey

Ctrl + Alt + Shift + F11 closes the application completely.

SmartScreen behavior

Windows may display a SmartScreen warning on first launch because the lightweight utility is not yet code-signed. The documented procedure is More info -> Run anyway. In managed environments, an IT administrator may need to allow the file explicitly.

Privacy and transparency

Property	Documented behavior
Execution	Runs locally on the Windows computer.
Network access	No network access is required for normal operation.
Telemetry	No telemetry or analytics collection.
Clipboard	Symbols are inserted directly; the clipboard is not used.
Source availability	The Windows mapping project is available publicly on GitHub.
Framework	The companion application is built with AutoHotkey, an open-source Windows automation framework.

5. Application compatibility

Compatibility is primarily determined by two factors: whether the target application accepts standard Unicode text input, and whether the application reserves one of the same shortcuts for its own commands.

Application or context	Status	Notes
Microsoft Word	Tested	Works well. For structured equations, use Word equation mode (Alt + =).
LibreOffice Writer	Tested	Works well for standard text entry.
Google Docs	Tested	Works well in the browser; browser or extension shortcuts can occasionally conflict.
Notepad	Tested	Useful as a neutral application for verifying setup.
Notepad++	Tested	Works well for standard text entry.
OneNote	Tested	Works well for standard text entry.
Other editors	Usually works	A reserved shortcut may trigger the application command instead of inserting the symbol.

Word-specific guidance

For mathematical content in Microsoft Word, the best results are usually obtained inside a Word equation object. Press Alt + = to create an equation, then use the Nitrax symbol shortcuts while continuing to write inside the equation field.

Keyboard layout considerations

The printed legends are designed around a QWERTY-like physical layout. On AZERTY or QWERTZ systems, shortcuts may still operate, but the physical key position may not correspond intuitively to the printed legend. Users who need exact positional matching can temporarily select a compatible operating-system input layout.

Operating-system status

Platform	Keyboard operation	Math-layer status
Windows	Standard keyboard plus Windows OS mode	Supported through the Windows companion application.
macOS	Standard keyboard in Mac mode (Fn + W)	The Windows companion application does not provide the math layers on macOS.
Other systems	May operate as a standard keyboard depending on host support	No official companion layer is documented in this Version 1.0 report.

6. Hardware and connectivity

Form factor	Compact external keyboard
Approximate dimensions	295 x 128 x 22 mm
Approximate weight	300 g
Charging	USB-C; typical full charge around 2 hours
Typical operating time	Approximately 70 hours under documented usage conditions
Power management	Automatic sleep after approximately 10 minutes of inactivity
Wireless modes	2.4 GHz USB receiver or Bluetooth
Typical range	Approximately 8-10 m, depending on the environment
Receiver storage	Recessed storage slot under the keyboard
OS mode shortcuts	Fn + Q for Windows mode; Fn + W for Mac mode

2.4 GHz receiver mode

6. Remove the USB receiver from its storage slot and connect it to the computer.
7. Power on the keyboard and select 2.4G mode.
8. If reconnection is required, hold the 2.4G button for approximately 3 seconds until the indicator flashes rapidly.

Bluetooth mode

9. Select Bluetooth mode on the keyboard.
10. Hold the Bluetooth button for approximately 3 seconds to enter pairing mode.
11. Open the computer Bluetooth settings, add a device, and select the keyboard. Depending on the batch, the device may appear as IOP 582, IOP 583, or IOP 584.

> **Connection model**
>
> The keyboard uses one active wireless connection mode at a time. It typically remembers the last selected mode and reconnects after power-on.

7. Initial setup and troubleshooting

First-use checklist

12. Turn the physical power switch on.
13. Connect through the 2.4 GHz receiver or Bluetooth.
14. On Windows, select Windows mode with Fn + Q.
15. Download and run the latest Windows companion application.
16. Enable Math Mode from the tray icon.
17. Open Notepad and test Ctrl + Alt + T -> √.
18. Test Ctrl + Alt + Shift + J -> ∫.

Common issues

Symptom	Likely cause	Recommended action
No symbol appears	App not running or Math Mode is off	Start the application, enable Math Mode, and test in Notepad.
Tray icon not visible	Icon is hidden in the tray overflow	Open the ^ tray overflow and locate the Nitrax icon.
Shortcut triggers another action	The application reserves the shortcut	Test in another editor or temporarily disable Math Mode.
Windows key or AI key behaves unexpectedly	Keyboard is in Mac mode	Press Fn + Q to select Windows mode.
Bluetooth will not reconnect	Stale pairing or pairing mode inactive	Remove the old Bluetooth device and pair again.
2.4 GHz mode will not connect	Receiver or mode not selected	Reconnect the receiver, select 2.4G, and re-pair if necessary.
SmartScreen warning	Unsigned executable reputation warning	Select More info -> Run anyway, or request an IT allowlist exception.

Diagnostic principle

Notepad is the recommended neutral test environment. If a shortcut works there but not in a specific application, the issue is likely an application-level shortcut conflict rather than the keyboard or companion utility.

8. Limitations and interpretation

This report documents the current product and software behavior. It should not be interpreted as evidence of a quantified productivity improvement unless supported by a separate controlled study.

Known limitations

- Math-layer support documented here is centered on the Windows companion application.
- Application-specific shortcut conflicts can prevent individual mappings from operating in a given program.
- Unicode character insertion does not automatically create semantic equation structure or advanced typesetting.
- The physical legends are optimized for a QWERTY-like layout and may feel less direct on other host layouts.
- Wireless range and battery duration vary with environment, usage, host hardware, and power conditions.
- The device exposes a curated set of symbols; specialized disciplines may require additional characters or custom macros.

Versioning policy

Material changes to the symbol map, hardware, supported platforms, software behavior, or compatibility guidance should be documented in a new report version. Zenodo versioning can preserve earlier releases while providing a stable concept record for the resource family.

Recommended future research

Timed input benchmark

Compare completion time for representative symbol-entry tasks using Nitrax, application menus, copy and paste, and memorized codes.

Learning curve study

Measure performance and error rate over repeated sessions to estimate how quickly the shortcut system becomes habitual.

Workload assessment

Use a structured questionnaire to compare perceived interruption and cognitive effort across input methods.

Discipline-specific coverage

Evaluate whether the symbol set covers common workflows in calculus, physics, statistics, engineering, and scientific writing.

Research integrity

Any future benchmark should publish its protocol, raw or anonymized data, task set, participant criteria, analysis method, and limitations separately from product marketing.

9. Official resources and citation

Official resources

Official website: https://mathematicalkeyboard.com/

Canonical technical-reference page: https://mathematicalkeyboard.com/nitrax-mathematical-keyboard-technical-reference/

Full documentation: https://mathematicalkeyboard.com/full-documentation/

Quick Start: https://mathematicalkeyboard.com/how-to-use-the-nitrax-math-keyboard/

Open-source Windows software: https://github.com/NitraxMathematicalKeyboard/download-keyboard-layout

Zenodo DOI: https://doi.org/10.5281/zenodo.20744644

Recommended citation

APA-style citation

Sitbon, R. (2026). Nitrax Mathematical Keyboard: Technical Reference, Symbol Input Method, Compatibility, and Usage Guide (Version 1.0). Nitrax Mathematical Keyboard. https://doi.org/10.5281/zenodo.20744644

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Revision record

Version	Date	Summary
1.0	June 2026	Initial public technical reference covering the product concept, symbol input method, Windows application, compatibility, hardware, privacy, setup, limitations, and official resources.

Contact

Corrections, compatibility feedback, and requests for missing symbols can be submitted through the contact section of the official Nitrax Mathematical Keyboard website.